NATURELA ELECTRONICS
13 ANA FELIXOVA
9020 VARNA, BULGARIA
WWW.NATURELA-BG.COM
+359 52 504 506
+359 52 504 507
office@naturela-bg.com

GLC CERTIFIED ISO 9001

Digital Electronic Controller for Water Heaters with Solar collector

NHC-H34

software version 2.1

User manual

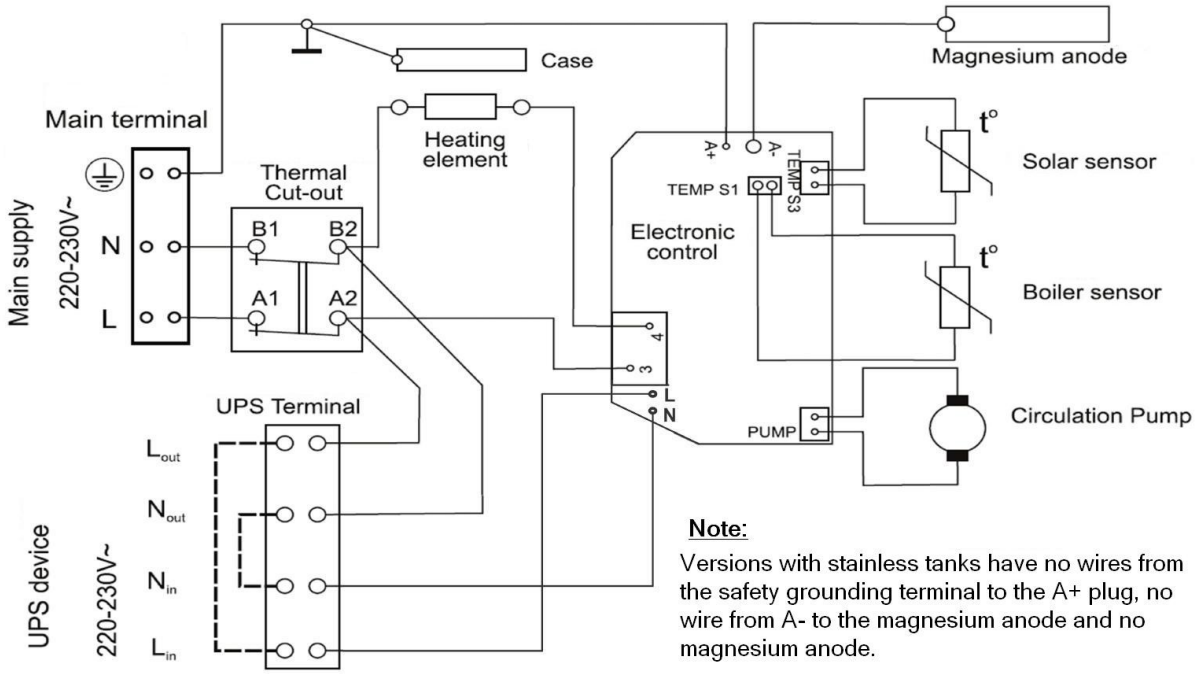
NHC-H34 is a temperature regulator with a modern and effective look, designed to control an electrical water heater, combined with a hot water installation with a solar collector. It has a graphic LCD display with the ability to show different types of information, which allows adding many new and useful options. The main advantage of this temperature regulator is the joint control of the electrical heater and the solar collector, due to the built-in differential temperature regulator. For example, if the sun wasn't strong enough during the day, you can always set up the controller to turn the electrical heater on, so the water heater will be ready for you with enough hot water.

Specific advantages of the temperature regulator NHC-H34:

- Uses energy from the electrical heater, if the water is not heated up enough by the solar collector
- Protects the water heater and the solar collector of freezing.
- Protects the solar collector of overheating. If the hot water in the water heater is not going to be used for a long time, the Holiday mode might be activated, which automatically takes the heat off from the water heater during the night, so it can be warmed up again on the next day

and takes the heat off from the solar collector.

- Information about the condition of the anode protector.
- Information if a leakage from the heater to a hull higher than 30mA occurs and automatically turning off the water heater when such a leakage is registered.
- Uses self adapting and energy saving algorithm for heating up the water with the electrical heater.
- Diagnostics of all used circuits.
- Two timers which allows you to set up the active time of the electrical heater. This might be used, for instance, for automatic work only in the time interval with cheaper electricity rates or to set up a time when the water heater starts being electrically heated up if the sun wasn't strong enough by this time.
- System time and date. Knowing what time it is while you are in the bathroom is really convenient.
- Measures the consumed electricity in kWh and shows it in a digital view for two rates or in a graphic view hour by hour for the whole day.
- Shows at the same time the temperature of the water in the upper and the bottom section of the water heater and the temperature in the solar collector's heat exchanger.
- Monitors the condition of the heater and shows a message if the water is not heated up for the presumed time.



Connection scheme of NHC-H34 with a water heater

Information displayed on the main screen

The display has three main designs. They show different views of the main conditions: Water Heater ON, Water Heater OFF and Setup

„Design I“ - Water Heater Off

When the water heater is off, on the screen are displayed date, time, the current temperature of the water and the condition of the tank's anode protector. If a problem occurs, the indicator for the condition of the anode protector switches with an error message.

„Design II“ - Water Heater On

When it is on, the water heater works on one of its work modes:

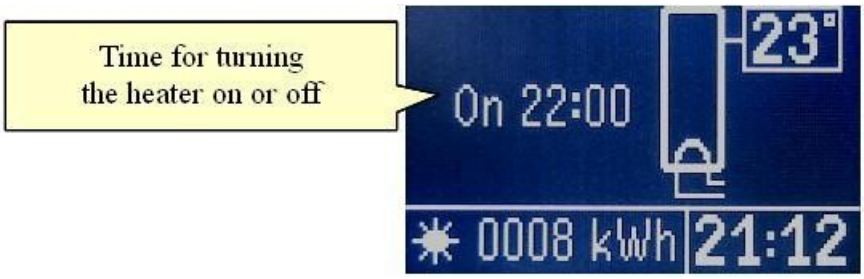
- Automatic mode with electrical water heating
- Mode with electrical water heating in a restricted part of the day
- Combined mode
- Solar mode
- Holiday mode for automatic protecting the solar collector from overheating

Automatic mode with electrical water heating

On this mode the water is heated up only by the electrical heater of the water heater and it keeps the set temperature. The turned on heater is visualized on the screen by moving “bubbles” above the heater.

This mode is appropriate when the water heater is intensively used, when hot water is constantly necessary, when fast heating up the water is required or there is not enough solar energy.

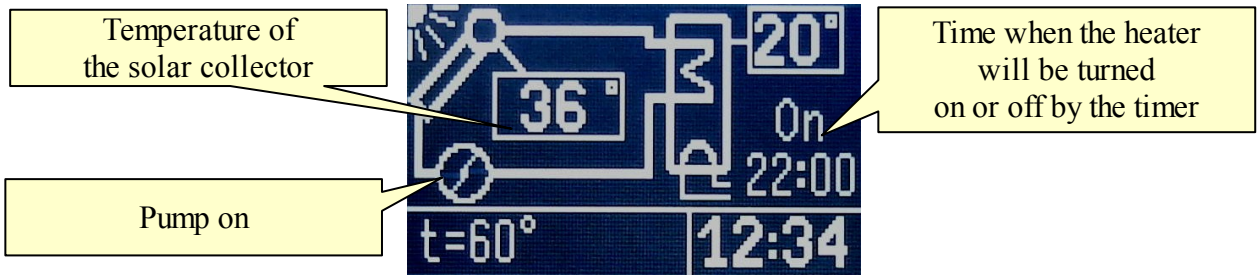
Mode with electrical heating the water in a restricted part of the day



On this mode the water is heated only by the electrical heater of the water heater, as its work can be restricted by setting intervals of the day when the heater is on. The beginning or the end of the work period are displayed on the left side of the screen. The start time is displayed when it hasn't come yet, and after the heater turns on the end time is displayed. The turned on heater is visualized on the screen by moving “bubbles” above the heater.

This mode is appropriate in cases when the solar energy is not enough for heating up the water or allows usage of the cheaper night electricity.

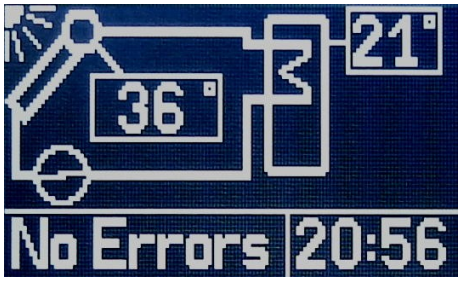
Combined mode



On this mode the water is heated up both by the electrical heater of the water heater and by the serpentine which is connected to the solar collector installation, as the heater can work only on certain periods of the day. The beginning or the end of the work period of the heater is displayed on the right side of the screen. The start time is displayed when it hasn't come yet, and after the heater turns on the end time is displayed. The turned on heater is visualized on the screen by moving “bubbles” above the heater. When the circulation pump of the solar installation turns on, this also appears on the screen.

The combined mode allows full use of the solar energy for heating up the water during the day and use of the electrical heater for keeping the temperature during the night or for additional heating up the water when the solar energy is not enough.

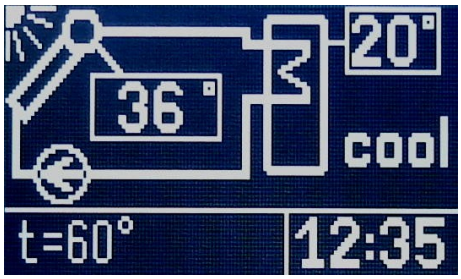
Heating up by a solar collector



On this mode the water is heated only by the solar collector's installation. When the solar installation circulation pump turns on, it is visualized on the screen.

The Solar mode is appropriate for cases when the solar energy is enough to provide the required amounts of hot water.

Holiday mode



If you are not using hot water for a long time, for instance if you are on vacation, business trip, etc. and during this season the sun is strong enough, the water heater will heat too much. Therefore, it won't be able to accumulate much heat energy and the solar collector won't be able to cool itself by giving off its heat to the water heater. To prevent the collector's overheating and to protect the whole installation, the Holiday mode has been made. On this work mode, during the interval set in the setting Holiday Mode (which should be in the night), if the temperature in the water heater is over 35 degrees and the temperature of the collector is at least 10 degrees lower, the circulation pump turns on and the heat, accumulated in the water heater, goes to the solar collector. When the sun doesn't shine, the solar collector can only cool the water running through it and therefore the water heater, as well. The pump works until the temperature in the water heater goes below 30 degrees or until the temperature of the collector is only 5 degrees lower than the temperature in the water heater. With this function of the electronic control, enough heat is taken from the tank in the night, so that when the sun rises up again and the temperature in the collector gets the limit set in **Solar Max Temp → Pump On,** the pump turns on and takes the heat from the collector to the water heater.

Measured or set parameters

On every work mode, in this field you can find useful information about the measured values, which are not displayed on the main screen, and about some of the set work parameters of the system. All possible data is displayed successively by pressing the **View/Enter** button. It appears in the following order:

t=60°	Set temperature
t_1=22°	Temperature of the water heater, measured in its bottom section
t_3=23°	Temperature of the solar collector
11-11-2011	Date
A □□□□□	Indicator for the condition of the anode protector
☀ 0008 kWh	Electricity consumed on daily rate
☾ 0000 kWh	Electricity consumed on night rate
☀ 06:00	Start time of the daily rate for calculation the consumed electricity
☾ 22:00	Start time of the night rate for calculation the consumed electricity
Δt_1On=10°	Minimum temperature difference between the temperatures of the solar collector and the bottom section of the water heater (t3-t1), for turning on the pump
Δt_1Off=05°	Temperature difference (t3-t1) for turning off the pump
On_1 22:00	Start of the first interval (timer) which allows the heater's work
Off_1 06:00	End of the first interval (timer) which allows the heater's work
On_2 13:00	Start of the second interval (timer) which allows the heater's work
Off_2 15:00	End of the second interval (timer) which allows the heater's work
On_h 23:00	Start of the interval which allows the pump's work for taking off the heat from the water heater on Holiday mode
Off_h 06:00	End of the interval which allows the pump's work for taking off the heat from the water heater on Holiday mode
No Errors	Messages for registered errors
(*the view is below* *)	Consummation for the last twenty-four hours

Messages for registered errors

- **No errors** – No registered errors
- **Anode Low** – Reduced size of the anode protector. A check is required.
- **Leakage** – A leakage from the heater to the water heater is registered. In this case the water heater turns off and the next turning on is possible after turning it off from the electrical power panel.
- **No heat** – The heater is on, but the temperature in the water heater does not increase
- **S1 E1** – A breakdown in the temperature sensor in the bottom section of the water heater. It is broken or disconnected.
- **S1 E2** – A breakdown in the temperature sensor in the bottom section of the water heater. It is on short circuit.
- **S1 Frost** – On turning on the power, the water in the water heater has a negative temperature and it is possible to be frozen. Should check the tank's completeness before turning on the power again.
- **S2 E1** – A breakdown in the temperature sensor in the upper section of the water heater. It is broken or disconnected.
- **S2 E2** – A breakdown in the temperature sensor in the bottom section of the water heater. It is on short circuit.
- **S2 Frost** – The temperature sensor in the upper section of the water heater registers negative temperature.
- **Overheat1** – The collector's temperature is over the set temperature for turning the pump on to prevent the collector from overheating, but the water in the water heater has reached the maximum allowed temperature and the function for preventing the collector from overheating won't work.
- **S3 E1** – A breakdown in the temperature sensor of the collector. It is broken or disconnected. Only modes with electrical heating will work.
- **S3 E2** – A breakdown in the temperature sensor of the collector. It is on short circuit. Only modes with electrical heating will work.
- **S3 Frost** – The temperature sensor of the collector has registered temperature lower than the set critical minimum temperature and it is possible the fluid to be frozen. Only work modes with electrical heating will work. Should check the system completeness, before turning it on again.
- **Overheat2** – The temperature sensor of the collector has registered temperature higher than the set critical maximum temperature. Only modes with electrical heating will work. Should check the system completeness, before turning it on again.

*** Consummation for the last 24 hours**

The last system information, Consummation for the last twenty-four hours, displays on full screen a diagram of the heater's work for the day, hour by hour. On the top of the screen is shown the date, which the information is for and the field in the bottom left corner, where the rest of the parameters appear, displays the total consumed electricity for that date. The information appears for 30 seconds or until a button is pressed, then the screen goes back to its initial state.

Important

*If the consumed daily or night electricity is displayed in the field **Measured or set parameters**, pressing and holding the **View/Enter** button for more than 1.5 seconds will reset this*

information.

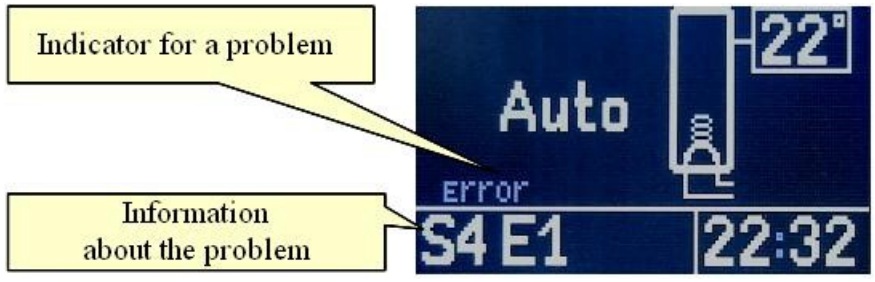
The information about the work intervals of the heater contains the real work intervals of the heater, as a combination of the two set intervals. When the interval is not activated, instead of its start and end, "-- : --" is displayed. If both of the intervals are not activated or they cover the whole day, the heater will work with no restriction.

System time field
shows the current time. If the clock is not set, this field blinks. *The temperature regulator has a battery, which keeps the timing on if the power supply is off for short time. The maximum time for keeping the timing on is 18 hours, after that the clock turns off and needs to be set again.*

Water temperature field
gives information about the current temperature of the water in the upper section of the tank. *Should have in mind, that if a breakdown of the temperature sensor in the upper section of the tank occurs, the data from the temperature sensor in the bottom section of the tank will be displayed. And the hot water goes to the upper section and from there to the pipeline installation of the house. Therefore, it is possible, despite of the displayed by the temperature regulator low temperature, the real temperature of the water to be much higher. <u>This is a restriction of the temperature measuring method and it is necessary to pay attention when using only not cooled hot water.</u>*

On activating the **ECO mode**, the temperature automatically sets on 60°C. Working on ECO mode is indicated by displaying "E" on the top right corner of the screen. Also, while displaying the set temperature in the Measured or set parameters field, instead of the temperature, a sign "ECO" appears.

When the water heater is on, if there are any registered problems, on the bottom side of the field, which displays the work mode (above the "Measured or set parameters" field), appears a blinking sign **Error.** An information about the registered problem can be found in the **Measured or set parameters** field.



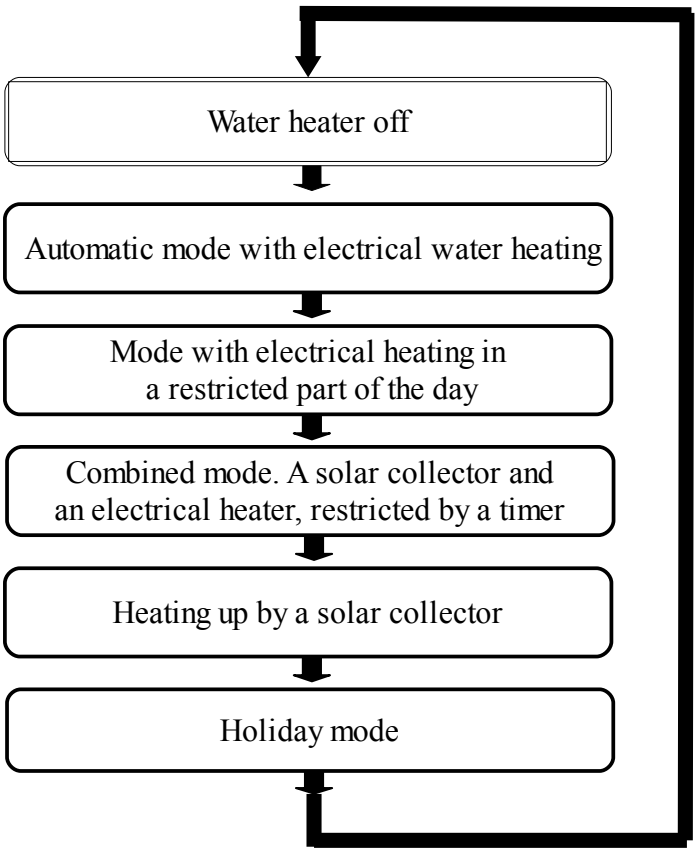
„Design III“ - Settings

The screen has a similar look for all the settings of the work parameters. On the picture is the setting of the time intervals. The values or numbers, which are going to be changed by pressing „▲“ or „▼“ buttons, are blinking. To proceed to setting the next value of the same parameter, the **View/Enter** button should be pressed. To end with the current setting, the **Mode/Set** button should be pressed. This forwards to the next setting, if any, or gets back to the main screen. If no action has been taken for a certain time, also appears the main screen, but the changes won't be saved.

Work with the temperature regulator

Turning on, changing the mode and turning off the water heater

Pressing the **Mode/Set** button turns on, changes the modes and turns off the water heater, as the order of the states is the following:


Water heater off
Automatic mode with electrical water heating
Mode with electrical heating in a restricted part of the day
Combined mode. A solar collector and an electrical heater, restricted by a timer
Heating up by a solar collector
Holiday mode

When the water heater is off, the display is in **Design I.** By pressing the **Mode/Set** button, the water heater turns to Automatic mode with electrical heating up the water and the display changes according to this mode. By pressing again the **Mode/Set** button, the work mode of the water heater changes and the display changes too according to the new mode. After going through all the possible work modes, the water heater turns off, the display goes back to **Design I**, and the heater and the pump turn off, if they were on. On this mode the indication of the anode protection, the clock and the indication of the water temperature remain.

Setting the temperature

When the water heater is on, by pressing any of the buttons "▲" or "▼", the mode **Changing the set temperature** activates. Further pressing the same buttons changes the temperature setting. By pressing the **View/Enter** button, the new setting is saved and the display goes back to its previous state. If no button has been pressed for 5 seconds, the display goes back to its previous state, but the changes won't be saved. If one of the buttons "▲" or "▼" is pressed and held for more than 0.8 seconds, the value of the temperature automatically increases or decreases with 3 digits per second. Pressing "▲" and "▼" at the same time and holding them for more than 0.8 sec. turns on the ECO mode and returns the main screen. The ECO mode can be activated directly by pressing both buttons while on main screen (without entering the setting Changing the set temperature). The temperature can be adjusted from 20 to 75°C.

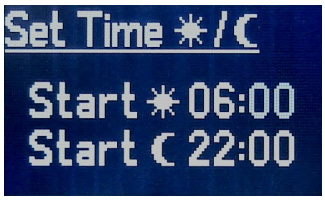
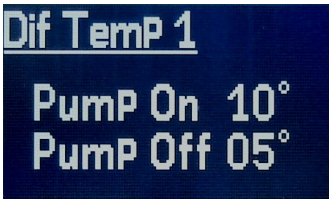
Safety modes

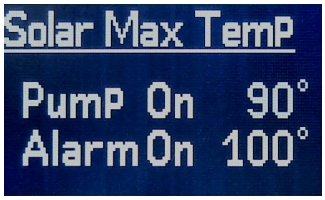
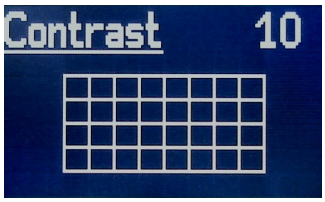
No matter whether the water heater is on or off, or which mode is currently activated, the temperature regulator constantly monitors the temperature both of the water in the tank and of the solar collector, and if it is necessary activates safety mode to protect the tank or the collector of freezing or safety mode to protect the collector of overheating. Therefore, if there is a forecast for low temperatures or a chance for the collector to get overheated, it is recommended not to turn off the water heater from the power mains!

Setting mode

Most of the water heater's predefined parameters could be adjusted. Entering Setting mode is available from **Design II** of the screen, when the water heater is on, by pressing and holding for

more than 1.5 seconds the **Mode/Set** button. Exception of the rule for the water heater to be on, is the setting of the time and date, when they are blinking, i.e. they haven't been set yet. In this case this setting could be done even if the water heater is off. By entering the Setting mode, the screen goes to **Design III**. Pressing **Mode/Set** button forwards to the next setting screen. The order of the settings is the following:

1		Setting time
2		Setting date
3		Setting the time interval when the pump can turn on to take the heat energy to the solar collector on Holiday mode. *This interval must be in the night, for this mode to make sense!*
4		Setting time intervals which allow the electrical heater to turn on (Setting timer)
5		Setting start of the daily and night electricity rates. An important information for correct reporting the consumed electricity.
6		Setting the differential temperatures between the solar collector and the water heater for turning the pump on or off. For a temperature difference between the collector and the water heater more than **Pump On**, the pump will turn on and will work until the difference gets less than **Pump Off.**
7		Setting temperature for protecting the collector from freezing and a critical minimum temperature. If the collector's temperature is the same as in **Pump On,** the pump turns on to take heat from the water heater to the collector.

8		Setting temperature for protecting the collector from overheating and a critical maximum temperature. On getting the **Pump On** temperature, the pump turns on to take the heat from the collector to the water heater. *This protection works no matter the current work mode!!!*
9		Setting display contrast.

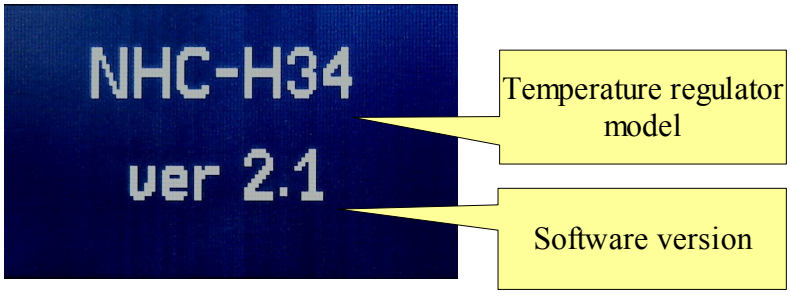
Caution:

- *Using the electrical power panel for turning on and off the water heater, doesn't change the set temperature and the water heater's last work mode before the turning off. If the water heater was on, by turning it off and then on again, it will be on the same mode with the same set temperature.*
- *When you are not using hot water for a long time and the sun is strong in this period, do not turn the water heater off from the electrical power panel. This might damage the collector. Use the **Holiday mode**, which automatically protects the whole solar installation.*
- *The water heater's clock is run by a lithium battery even if the water heater is off from the electrical power panel or failure of the power supply network occurs (no electricity). For the battery not to run down if the water heater is off for a long time, when there is no power supply for more than 18 hours, the clock stops and on the next turning on, the time won't be correct. This case is indicated by blinking time and date. A new time setting is required!*

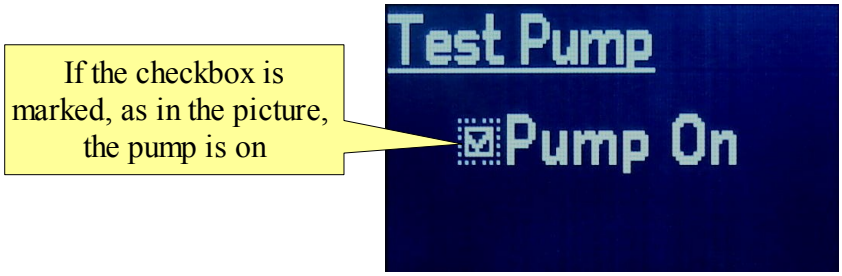
Water heater initial settings

The temperature regulators NHC-H34 are designed for different types of water heaters. The necessary personalization is not made in the factory and after you install your water heater it is required to enter some information about the heater's power and presence of an anode protection (if the water heater is made of stainless steal it has no anode protection). By default are entered parameters for a water heater with 3kW heater and anode protection. If your water heater is the same, no additional personalization is required.

When the water heater is off, pressing and holding „F" and **"↵"** at the same time for more than 4 seconds enters the Initial settings mode. It is easier to do this as you press and hold "F" first and then **"↵".** After the button combination is recognized, first the screen displays the version of the controller and the software:



The following pressing the “F” button enters a mode for hand management of the solar collector's circulation pump. “▲” and “▼” turn the check marker on or off, which turns the pump on or off:



On pressing the “F” button again, the Initial settings screen appears:

For changing the initial settings, use the following instructions:

- the field which is going to be changed is blinking
- process to the next field of the same parameter by pressing “↵” button and the new field starts blinking
- increase the value of the blinking field by pressing “▲” button and decrease it by pressing “▼” button.
- Pressing the “F” button saves the changes, which have been made and forwards to the next parameter, if any, or to “Water heater Off” mode.